SOUTHEASTERN BIOLOGY

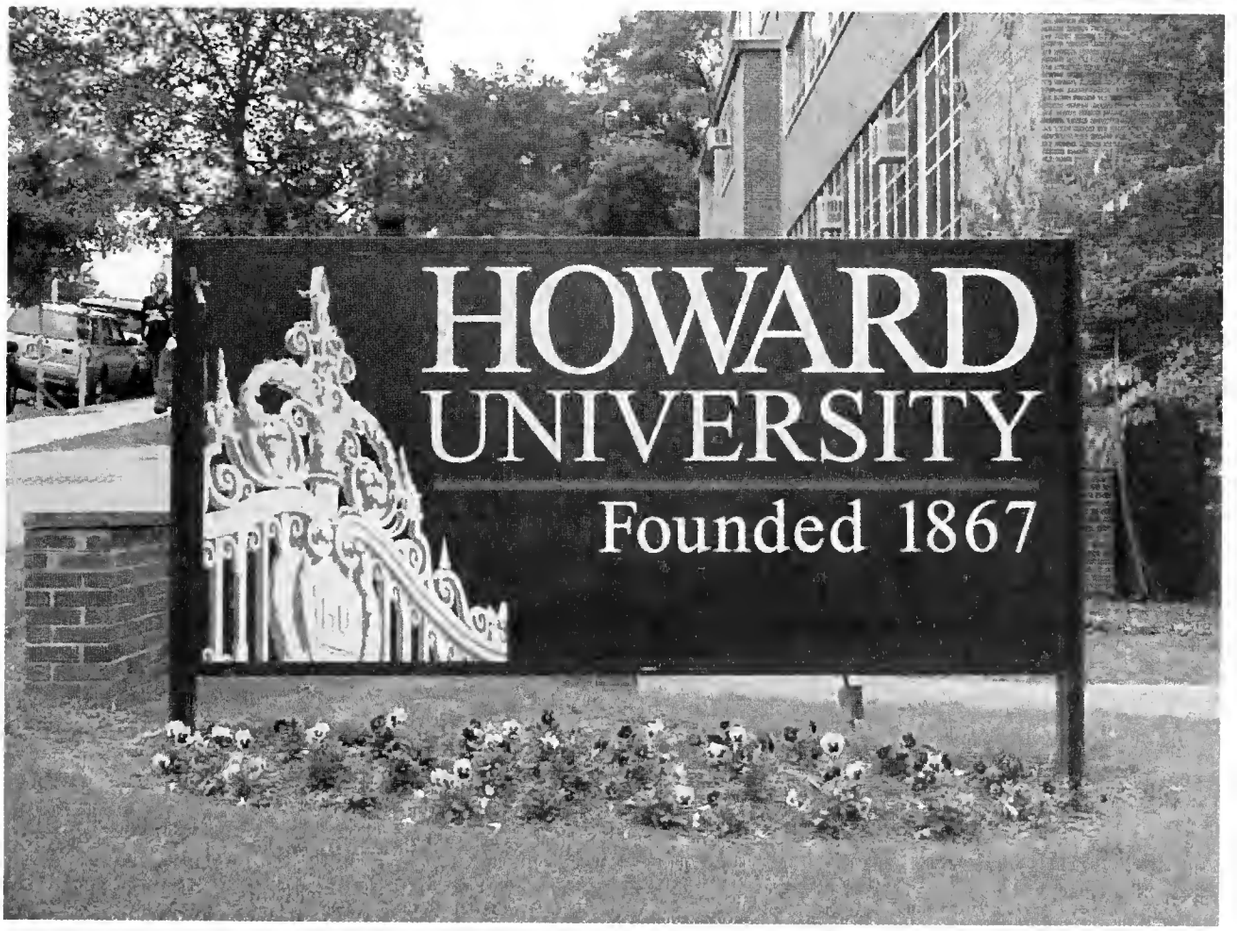
ume 49 December, 2002 Number 4

ASB 64TH ANNUAL MEETING
APRIL 9-12, 2003

Department of Biology
Howard University, Washington, D.C.

Department of Natural Sciences
Bowie State University, Bowie, Maryland

See Page 361 and Consult Website
http://www.biology.howard.edu/asb2003.htm



The Official Publication of
The Association of Southeastern Biologists
http://www.asb.appstate.edu/

SOUTHEASTERN BIOLOGY

(ISSN 1533-8436)

SOUTHEASTERN BIOLOGY (ISSN 1533-8436) is published quarterly in January, April, September, and December by the Association of Southeastern Biologists, Inc., Carolina Biological Supply Co., 2700 York Road, Burlington, NC 27215. Periodicals postage paid at Burlington, NC, and additional mailing offices. POSTMASTER: please send address changes to the SOUTHEASTERN BIOLOGY business manager, Tim Atkinson, Carolina Biological Supply Co., 2700 York Road, Burlington, NC 27215. ASB members receive the SOUTHEASTERN BIOLOGY as part of their membership dues. For non-members, the cost is $5.00 per issue.

All contributions, inquiries about missing numbers and other matters should be addressed to the Print Editor. News items should be sent to the News Editor. Send books to be reviewed to the Book Review Editor. Printed by Allen Press, 1041 New Hampshire St., Lawrence, KS 66044.

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ASB Officers

Purpose

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

Time and Place of Future Meetings

2003	April 9-12	Co-hosted by Howard University, Washington, DC, and Bowie State University, Bowie, Maryland; see http://www.biology.howard.edu/asb2003.htm
2004	April 14-17	Co-hosted by Univ. of Memphis, Rhodes College, and Christian Brothers Univ., Memphis, Tenn.

64TH ANNUAL MEETING AT-A-GLANCE

The 64th Annual Meeting of the Association of Southeastern Biologists will be held in Washington, DC, from April 9-13, 2003. The co-hosts are Howard University and Bowie State University. The Local Arrangement Committee, co-chaired by Lafayette Frederick and Geraldine W. Twitty, consists of faculty in the College of Arts and Sciences at Howard University and the Natural Science Department at Bowie State University. The Program Chair is Elaine J. Davis of Bowie State University. A website has been established at www.biology.howard.edu/ASB/ASBstart_here.html. Please visit this site for more detailed information and registration information. Online registration is an option to the more traditional registration format.

Highlights of the meeting will include a plenary address on Wednesday, April 9th at 6 pm followed by a reception, several symposia and workshops; an **exciting** Thursday evening social, a variety of contributed papers and poster sessions, a diverse selection of field trips of both scientific and national interest and a **fabulous concluding** banquet. The field trips include Washington Afterdark, the U.S. National Arboretum, the National Zoological Park, Patuxent Wildlife Center, National Museum of Natural History, National Gallery of Art, Great Falls, and Arlington Cemetery. The cherry blossoms have been ordered to stay in place until our meeting is concluded!

The venue for the meeting is the Crystal City Hyatt Regency Hotel, 2799 Jefferson Davis Highway, Arlington, Virginia. The newly renovated hotel offers deluxe rooms, many with views of the Potomac River, Washington Monument, and the U.S. Capitol. The entire meeting will take place at the hotel with the exception of the Thursday evening social. Participants are expected to contact the hotel directly for housing. The hotel is conveniently located one-half mile from Ronald Reagan National Airport. Complimentary shuttle services to and from the airport are provided by the hotel. Guest rates at the hotel are $159.00 [single/double occupancy], $169.00 [triple occupancy], $179.00 [quadruple occupancy], $450.00 [one bedroom Executive Suite] or $ 575.00 [one bedroom Regency Suite]. The hotel also offers a special rate of $179.00 per night that includes daily breakfast and all local telephone calls.

Registration rates for the meeting are as follows: Early registration [received prior to 7 March 2003] is $150 for ASB regular members, and $100 for students. Late registration is $175 for ASB regular members, and $120 for students. Nonmembers will be charged $179 early registration; $200 late registration. This includes a one-year membership in ASB. Registration forms will be available on the ASB meeting website.

LOCAL ARRANGEMENTS COMMITTEE

The address (not identified otherwise) for Chairs/Co-Chairs is: Department of Biology, Howard University, Washington, DC 20059. FAX number for the Biology Department is 202-806-4564. FAX for Dr. Davis is 301 860 3887.

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AFFILIATE SOCIETIES MEETING WITH ASB IN APRIL 2003
HOSTS: HOWARD UNIVERSITY/BOWIE STATE UNIVERSITY

The following affiliate societies will be in attendance at the 2003 Annual Meeting. We anticipate an unprecedented diversity of paper and poster presentations. The societies and their contacts are listed below and on the ASB website.

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Some members of the ASB Executive Committee and guests enjoy barbecue at Dreamland in Birmingham, Alabama, Friday evening, September 28, 2001, before the Saturday Interim Executive Committee Meeting. Clockwise: Mike Dennis, Kim Marie Tolson, Bob George, Marilyn Caponetti, Joerg Henner-Lotze, Tim Atkinson, Robert Haynes, and Jim Caponetti.

Summary of AIBS Activities During 2001-02

From Geraldine W. Twitty, AIBS Representative
Howard University, Washington, D.C.

The annual meeting of the AIBS Council met on 25 March 2002 at the Key Bridge Marriott Hotel, Arlington, Virginia. Dr. Gene Likens, the 2002 President, gave the Call to Order, Quorum Call, and Agenda acceptance.

President's Comments. President Likens characterized AIBS in terms of its 6,000 individual members and 86 professional societies and organizations whose pooled membership encompasses more than 240,000 biologists. The current agenda of AIBS emphasizes networking, collaborating, and speaking up. ***BioScience*** is currently ranked fifth among the 51 biology journals. **BioOne** now offers more than 46 AIBS member-society journals an online access. Funding, database, and virtual library opportunities have been expanded. A pair of newly offered services are the Community of Science™ online database of public and private grants and awards worldwide for researchers, educators, and students and the AIBS Virtual Library, a compilation of online and CD-ROM lectures by some of the world's most prominent scientists and teachers, recorded at AIBS annual meetings. And finally, the national roundtable series has featured topics such as cloning, environmental and biodiversity policy, and bioterrorism.

DigiScript recorded all plenary lectures of the 2002 meeting and will make the recordings available FREE to all AIBS members in June 2002.

Immediate Past President's Comments (Dr. Judith S. Weis). There was an urgent call for support for both the teaching of evolution and the responsible revision of the traditional biology curriculum. A number of states are undertaking serious strategies that are designed to negatively impact the inclusion of evolution in the classroom. The members of the Council were asked to be actively involved in local and state legislative activities in an effort to sustain a responsible scientific approach. The Santorum amendment (Senator Rick Santorum [R-PA]) resulted in an unfortunate "Sense of the Senate" statement that incorporated language used by *intelligent design* proponents to undermine the teaching of evolution. The amendment passed 91-8 amidst a group of other amendments to the Elementary and Secondary Education Act. AIBS, along with several other societies, was successful in having the amendment shifted to "report language." It was noted that the original amendment will be cited by advocates for teaching intelligent design and creationism in an effort to influence the educational administrations to teach alternatives to evolution. (The new language is given at the end of this annual report.) On 13 January 2002, the Ohio State Board of Education subcommittee on standards considered a proposal to have an alternate set of science standards developed that would include intelligent design concepts.

President-Elect's Comments (Dr. Gary Hartshorn). In very brief comments, he called for a pledge of continuity, help in communicating science, and assistance with selecting themes for oncoming meetings. Among the proposed themes are: Bioscience and Industry, Biological Education, the Interface of Biology and Physics, Evolution and Development, Endangered Species, Public Health, and Integrating Public Policy.

Executive Director's Report (Richard O'Grady). Forty-five and the 86 representatives were in attendance at the Council Meeting. The highlights of this report included statements relating to (1) the continued success of the roundtable series that included Agricultural and Bioterrorism Threats to Natural and Urban Ecosystems; additional roundtables on the Ecology of Infectious Diseases and the Evolution of Resistance and Virulence are planned; (2) the full funding of two public policy employees from funds contributed by 18 member organizations; (3) the submission of a proposal to launch a "Biology Classroom on the Hill"; (4) continued attempts to create a Public Issues Council; (5) an involvement with NSF on NEON; (6) progress on the undergraduate curriculum; (7) exploration of online manuscript submission and review for *BioScience;* (8) success of the BioOne online journals publishing project; (9) success in the revised format of the 2002 meeting (Plenary session-discussion group); and (10) continued growth of AIBS. Beginning in June 2002, the AIBS Virtual Library of online lectures from the annual meetings will be free to all individual AIBS members.

Treasurer's Report (Dr. H. Jane Brockmann). Total revenue for the fiscal year was $3,822,300. Total expenses were $3,759,569. The total cash and investments at market value was $993,301. The net assets of AIBS continued to grow over the past year.

BioOne Presentation (Heather Joseph, President). BioOne is a non-profit corporation formed and operated as a collaboration between societies and libraries with shared research and scientific communications interests. Societies and other nonprofit and independent publishers of peer-reviewed journals are invited to consider participating as content providers to the BioOne aggregation in the field of organismal and integrative biology. In its first year of full-scale operation, 43 journals from 35 publishers were aggregated in a unified hyperlinked database. Paid access reached nearly 400 subscribers by December 2001. Within the revenue-sharing pool, 2001 payments will range from about $400 to over $63,000.

National Ecological Observatory Network (NEON) (Scott Collins, Program Manager). NEON is a continent-wide research network under the umbrella of NSF that will consist of geographically distributed observatories, linked via state-of-the-art communications. Each observatory will consist of a consortium of instrumented field sites and support institutions creating a regional "footprint." Collectively, it will create a virtual lab accessed by hundreds of scientists for research to obtain a predictive understanding of the environment. NEON will serve as a platform for answering large-scale ecological questions, will identify and address regional and continental scale problems, link a diversity of institutions and disciplines, provide real-time data for scientists, local governments, and other users, stimulate development of new instrumentation for

environmental research, and allow future real-time detection of environmental change as a result of biological and chemical agents.

Educational Committee (Dr. M. Patricia Morse). An advisory committee is working on plans to develop the framework and plan a model for workshops on faculty development. The immediate goal is to submit a proposal for the workshops to a funding agency. The ultimate goal is to improve undergraduate education in the biological sciences. Phase I will include meetings in conjunction with Project Kaleidoscope, May 31-June 4 in Williamsburg, Virginia. Meetings of the Writing Team at the University of Washington will be held from August 30-September 4 followed by peer review, final editing, and publication of the draft. Phase II will include planning meetings with Professional Societies and the Advisory Committee, workshops, and meetings of the AIBS National Workshop for representatives from the AIBS societies.

AIBS 2003 Annual Meeting

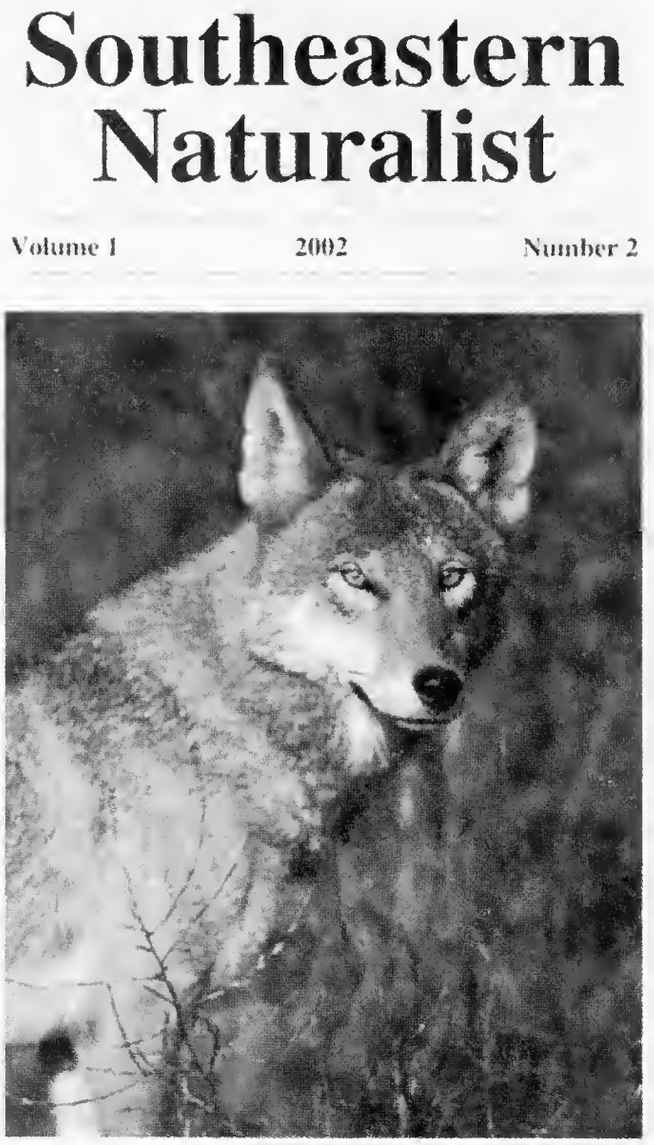
The topic of the 2003 annual meeting is "Bioethics." The one-day meeting will take place on Saturday, March 22, at the National Academy of Sciences, Washington, D.C. The Council will meet on Sunday, March 23, 2003.

Joint Explanatory Statement of the Committee of Conference text:

> The Conferees recognize that a quality science education should prepare students to distinguish the data and testable theories of science from religious or philosophical claims that are made in the name of science. Where topics are taught that may generate controversy (such as biological evolution), the curriculum should help students to understand the full range of scientific views that exist, why such topics may generate controversy, and how scientific discoveries can profoundly affect society.

Executive Committee members at the 2002 annual banquet. From left to right: Robert Haynes, Terry Richardson, Kenneth Shull, and Howard Neufeld.

The Southeastern Naturalist . . .



- A quarterly peer-reviewed and edited interdisciplinary scientific journal with a regional focus on the southeastern United States (ISSN #1528-7092).
- Featuring research articles, notes, and research summaries on terrestrial, freshwater, and marine organisms, and their habitats.
- Focusing on field ecology, biology, behavior, biogeography, taxonomy, evolution, anatomy, physiology, geology, and related fields. Manuscripts on genetics, molecular biology, archaeology, anthropology, etc., are welcome, especially if they provide natural history insights that are of interest to field scientists. Symposium proceedings are occasionally published.
- Indexed in Biological Abstracts (BIOSIS), BIOSIS Previews, CAB Abstracts, Cambridge Scientific Abstracts, EBSCO-host, Environmental Knowledge-base (formerly Environmental Periodicals Bibliography), FISHLIT (Fish and Fisheries Worldwide; Aquatic Biology, Aquaculture, and Fisheries Resources), Wildlife Review Abstracts, and Zoological Record (BIOSIS UK). Arrangements for indexing in Elsevier BIOBASE (Current Awareness in Biological Sciences), and ISI Services (Science Citation Index-Expanded, ISI Alerting Service, and Current Contents/Agriculture, Biology, and Environmental Sciences) are pending.
- A sister journal of the *Northeastern Naturalist* (ISSN #1092-6194), published since 1997. Both journals are identical in focus, format, quality, and features. The journals together serve as a matched-pair of regional journals that provide an integrated publishing and research resource for the eastern part of North America.
- Printed by Allen Press, printer of many journals in the biological and environmental sciences, especially those whose parent organization is a member of the American Institute of Biological Sciences (AIBS).
- Available online in full-text version in the BioOne database (www.bioone.org, a collaborative effort of Allen Press, AIBS, and other organizations) and the Proquest Information and Learning databases (www.il.proquest.com).

Recollections from 2002 ASB Keynote Address by Dr. Bruce Roe

Robert Y. George
Professor of Biological Sciences
University of North Carolina at Wilmington

ASB members tend to have a treat during the annual meetings by listening to outstanding keynote speakers who are genuinely chosen form the cadre of America's topnotch biologists. In the 60th ASB meeting in Wilmington (North Carolina), the twice Pulitzer prizewinner and Harvard's conservation biologist Professor Edward O. Wilson was the honored keynote speaker who eloquently presented his concepts of 'consilience' and 'biophilia'. We subsequently hosted world-renowned botanist Dr. Peter H. Raven, the President of the American Association for the Advancement of Science (AAAS), as our keynote speaker who addressed the decline of biodiversity and the challenges ahead for biologists in the 21st century.

The 63rd annual meeting of ASB at Boone at the Appalachian State University hosted as keynote speaker a great geneticist, Dr. Bruce Roe of Oklahoma University. His humor and his style of presentation still remain vividly in my mind, and let me share what we heard in the following paragraphs. He spoke about his sequencing the human 22nd chromosome that harbors leukemia gene and several other genes that are attributed to many human diseases including cancer and schizophrenia.

Having lost his suitcase in his flight, he stood in front of us in blue jeans and a rather old fashioned half-sleeve shirt. He confessed that he lacked the "shop gene", endemic to females only and therefore did not go to get a new suit and tie. He pulled out his belt with dramatic gestures and made a loop to simulate the double helix for explaining the structure of DNA. He pointed out that human chromosome 22 is the shortest but most important and that is why he devoted his life to decipher and map the genes on this chromosome.

Dr. Roe was very enthusiastic about the need to emphasize the human genome project. He told the audience in a fully packed auditorium that the total number of genes for sequencing to complete the human genome project is no longer 100,000 genes as originally envisaged but there are only 40,000 genes. He attributed the reduction to narrower coding region and deletion of pseudogenes and silent genes. When James Watson first launched on the human genome project, the tab for this task from taxpayers' dollars was 3 billion dollars, calculated on the basis of one dollar per base-pair. Dr. Roe informed us that the cost per base-pair came down subsequently to 50 cents and today it is just one cent.

With the drop in the cost for the quest coming down, we are approaching the successful completion of the human genome project much ahead of the target date. Dr. Roe told us that as of February 2001, 30% of the human genes are sequenced and now in April 2002, 80% of the 40,000 genes are sequenced. This

adds up to 2,869,462,5200 base-pairs (ACTG). "Wow, a remarkable progress, indeed"!

In the middle of his presentation, he loudly asked a bold question to the audience and said "Hey, look at your neighbor on the right or left, no matter what race, ethnic background or relations (wife, brother, sister, cousin, etc). Do you realize that you are 99.8% similar in gene sequence and just 0.2% different from each other?" Then he informed the audience that we humans are 40% similar to the bacteria, the organisms at the very bottom of the evolutionary tree.

For decades, we all heard that human *Homo sapiens* and chimpanzee *Pan troglodytes* DNA are 98.5% identical. However, most recently David Nelson, a geneticist at Baylor College of Medicine in Houston, Texas, concluded that on the basis of a more sophisticated method of sequencing genes measured the similarities between man and chimp DNA, these two primate species share 95% genetic material (not 95.5%). The DNA of humans and mice is only around 60% similar.

It is now recognized that substitution, wherein one of the four molecules that join to form DNA–called nucleotide–is replaced by one of the other three types (ACTG), is just not the only reason for change or mutation in gene sequence. We know now that single nucleotides or whole sections of DNA can end up being deleted or inserted into existing sequence. These kinds of mutations are labeled as "Indels". Nevertheless, Peter Oefner, a geneticist at Stanford's Genome Technology Center in Palo Alto, California, found that indels are common in the nonfunctional sections of human genome. He estimates that 97% of DNA in the human genome has no known function. We have not yet discovered a single indel in a gene to date between human and chimp. According to Oefner, human and chimp still differ 1% in gene sequence.

Presumably investigating the fundamental differences between human and chip genomes could provide fascinating new insights into language, intelligence and other factors that define our species *Homo sapiens*. Studying the differences between human and chimp genome may also provide insight into some of the human diseases like malaria and some types of cancer that chimpanzees do not suffer from.

Dr. Roe concluded his keynote address by emphatically stating that the completion of the human genome project is just like writing the "dictionary" but we are yet to write the "encyclopedia". He attributed the success of his discovery of sequencing the genes in human chromosome 22 in his laboratory in Oklahoma to 35 undergraduate students and six groups of graduate students (each group with four students). He also thanked his large BIO 101 class of 170 students and undergraduate molecular biology class (30 students) for giving him the fuel for energy to pursue his studies. His last slide was his class photo.

Dr. Bruce Roe

Dr. Bruce Roe

SYMPOSIUM

REGIONAL PARTNERSHIPS FOR ECOSYSTEM RESEARCH AND MANAGEMENT

Organizer: Beverly Collins
Savannah River Ecology Lab

A half-day symposium on partnerships for research and management of southeastern ecosystems was held Friday, April 12, 2002, in Trillium North of the Broyhill Inn on the Appalachian State University campus in Boone, NC. An introductory talk that presented opportunities and challenges for regional partnerships was followed by eight talks that highlighted successful examples. Closing remarks by H. Balbach highlighted the importance of looking beyond land and agency boundaries. The following is a summary of the symposium.

Public lands and challenges for regional ecosystem management

REBECCA R. SHARITZ (presenter)
BEVERLY S. COLLINS
Savannah River Ecology Lab, Aiken, CS 29802

The Southeast is changing. Expanding urban areas put pressure on resources and amplify the importance of public lands for conserving biodiversity. Benefits of regional and interagency partnerships for research and management of this dynamic landscape include sharing of data, which leads to a stronger basis for management decisions, and unified efforts to comply with regulatory issues such as maintaining habitat for threatened and endangered species. There are challenges to this regional approach, however, because of ecological differences among sites and different missions and goals among the federal and state agencies that manage them. Questions to consider are: 1) Does linking sites regionally serve as an antidote for fragmentation? 2) Can species and habitat management be more efficient at the regional scale? 3) Is it possible to overcome site and agency differences to achieve regional-scale management?

A Planning Framework for Conservation and Conservation Partnerships, an Example from Eglin Air Force Base

ROBERT SUTTER (presenter)
DORIA GORDON
The Nature Conservancy

Numerous factors have led to a larger scale approach to the conservation of biodiversity. From the scientific sector, ecological concepts have emphasized the importance of natural processes, ecosystem functionality, and landscape context.

Attempting conservation at larger scales means more partners (those with similar goals) and more stakeholders (those that influence and can be influenced by the project).

A planning framework developed by The Nature Conservancy identifies partnerships and significant stakeholders in the process of identifying high priority conservation strategies, metrics for adaptive management, and significant research needs. The framework is a progression from identifying the focus for conservation (conservation targets), the desired future condition of those targets (conservation goals), and an assessment of threats to the development of strategies and identification of metrics to measure the success of strategies. The framework focuses conservation work and priorities, balances conservation with other land uses, maximizes success, and initiates action and learning.

This planning framework has been the basis of a partnership between Eglin Air Force Base, in Northwest Florida, and The Nature Conservancy, and has been used to develop components of the base's Integrated Natural Resources Plan. An especially important part of the planning framework has been to involve experts who can provide the best available ecological information for priorities, conservation goals and management. Collaboration provides the needed expertise, develops shared goals and joint ownership, and allows for creative solutions. Within the context of the supportive leadership at the base, this information has led to an effective and efficient plan to conserve Eglin's biodiversity.

Developing ecosystem management tools for landscape-scale monitoring and management challenges

THERESA L. HOGAN (presenter)
RICHARD W. MCWHITE (presenter)
J. KEVIN HIERS
STEPHEN C. LAINE
Eglin Air Force Base Natural Resource Branch

Accomplishment of ecosystem management objectives across the Eglin Air Force Base landscape (186,000 ha) in the Florida Panhandle has necessitated the development of a comprehensive decision support system for exchange of ecological monitoring information and an ever-increasing refinement of geographic information system (GIS) tools to assess landscape conditions and to prioritize limited resources. By integrating field data and spatial modeling, Eglin has developed spatial modeling tools as an integral part of its ecological monitoring program for conservation targets. The results of these tools are available to managers through the Eglin intranet.

Following a simple modeling process that flows from conservation planning, these models 1) use existing research to define key factors that determine ecological conditions, 2) identify GIS data layers that directly or indirectly represent key factors, 3) weight each key factor as to its influence on overall

ecological condition, and 4) refine spatial models over time through monitoring, analysis, and research. This modeling approach states explicit assumptions about ecosystem processes that are then informed through future research. Current model iterations accurately classify sandhill condition into four or six categories with 85% and 71% accuracy, respectively.

While models are initially built on the best understanding of ecosystem condition through planning with experts, this approach is inherently adaptable as new research and analysis is incorporated into the selection and weighting of model parameters. An extensive ecological monitoring field effort complements these tools through status and trends assessment of conservation targets. Results are displayed in real time to managers through a web-based decision support system. Additional spatial modeling tools are then used to prioritize management actions, such as prescribed fire, across the landscape.

Herpetological inventories of the southeast coastal network National Parks

TRACEY D. TUBERVILLE (presenter)
SHANE LINDSAY
J. WHITFIELD GIBBONS
Savannah River Ecology Laboratory

MICHAEL E. DORCAS
Davidson College

The Southeast is the stronghold of amphibians and reptiles in North America. Of the more than 450 species of reptiles and amphibians native to North America, approximately half occur in the Southeast and about 20% are endemic. Recent worldwide declines of amphibians and reptiles have resulted in an increased need for research programs that monitor their populations. Basic inventories of selected locations are needed to initiate these programs. We have recently begun herpetological inventories of 16 parks within the National Park Service's Southeast Coastal Network, using a variety of sampling techniques that include coverboards, drift fences, road collecting, aquatic traps, systematic searches, and automated recording systems that monitor anuran vocalizations. We first developed lists of expected amphibian and reptile species based on published range maps and known habitat requirements of the animals. These lists are being refined using information on available habitats at the parks and data from local experts. We then will use a geographical information system to examine habitat use by amphibians and reptiles in selected parks and to make testable predictions about additional localities for species of concern. During the course of our inventory work, we will also be collecting biological samples for collaborative research projects with other institutions. By comparing our inventory data with previous surveys, museum records, and our expected species lists managers and researchers can evaluate historical and current herpetofaunal diversities and provide information critical to the planning and initiation of long-term monitoring programs.

The Longleaf Alliance: Restoring an Ecosystem Through a Regional Partnership

RHETT JOHNSON (presenter)
DEAN GJERSTAD
MARK HAINDS
JOHN MCGUIRE
Auburn University, Auburn, AL

The longleaf forest ecosystem may once have been the largest forest area on the continent dominated by a single species. An estimated 90 million acres of the southeastern United States contained longleaf pine and approximately 60 million acres were predominately longleaf. Today, less than 3 million acres of longleaf-dominated forest remain. In 1994, a group of forest managers and researchers met in Alabama to assess the condition of the longleaf resource as well as the level of interest in restoring it. A smaller group from Auburn University's School of Forestry and Wildlife Sciences took the lead in initiating that effort. Based at Auburn's Solon Dixon Forestry Education Center, the Alliance serves as a clearinghouse for information on the longleaf ecosystem, utilizing a network of partners as both sources and outlets for information. Much of the remaining longleaf is on public lands, primarily State and National Forests, National Wildlife Refuges, and military installations. That resource is currently being managed to restore ecosystem function, but comprises less than 10% of the region's forestland.

Working with partners from private industry, natural resource consultants, forest nurseries, state and federal natural resource agencies, the Department of Defense, universities and other research organizations, conservation groups, and private landowners, the Alliance provides newsletters, publications, videos, a website (www.longleafalliance.org), technical support, workshops, and conferences to a wide variety of audiences interested in longleaf ecosystems. Private landowners are seen as the key to significant recovery because over 90% of Southeastern timberland is privately owned. Today, the Alliance is at its highest level of staffing, with two full-time paid employees (a research coordinator and an outreach coordinator), one part-time clerical staffer, and two volunteer co-directors. Support comes entirely from memberships and grants. Despite the challenges of restoring an entire forest ecosystem type over an entire region, the Alliance has parlayed its efforts with those of its partners to literally make the whole much greater than the sum of its parts.

The Southern Appalachian Assessment: An exercise in interagency cooperation

CHARLES VAN SICKLE
Southern Appalachian Man and the Biosphere Foundation

The Southern Appalachian Assessment (SAA), completed in 1996, was a two-year interagency project that involved more than 11 federal agencies, 3 state

governments, and several non-governmental organizations. It was initiated in response to widespread concerns about changes affecting the environmental quality of the region. The Assessment was organized around four major environmental topics: Atmospheric, Aquatic, Terrestrial, and Social/Cultural/ Economic. It would describe current conditions and trends but would not make recommendations for management action. Initial plans emphasized moderate cost, timeliness, public participation, and objectivity. The project was based mainly on data that were already available from many government sources, but had never before been organized and assembled in one location. The SAA established a benchmark for future assessments and created a valuable archive for continuing reference and analysis. This Assessment has been used in many ways. It is the basis for coordinated forest plan revision on the five southern Appalachian National Forests. It has been used by several non-governmental organizations for policy formulation and by educational institutions for class study. Communities within the region have been encouraged to use the SAA database for planning and for developing indicators of community health and sustainability. The story of the SA Assessment contains valuable lessons, not only because of what it revealed about the condition of the region, but also because of the experience gained in interagency and interdisciplinary cooperation.

Fall Line Ecoregional Data Development

ROBERT C. LOZAR
Ecological Processes Systems Branch, Engineering Research and Development Center (ERDC-Champaign), Champaign IL 61826-9005

The Ecoregional Systems Heritage & Encroachment Monitoring (ESHEM) work is the initial attempt to examine issues of change, sustainment and land management at an ecosystem level. Recent technological advances have made this feasible only within the last few years. ERDC-Champaign in cooperation with Hunter College NY are developing an ecoregional database and monitoring configuration with the Sandhills as the first and most advanced prototype.

The initiative is grounded in specific requirements for managing or tracking the entire ecoregion (or sensible sub elements). ESHEM can spatially cover an entire ecosystem and temporally for the period from the 1960s to at least 2020. Monitoring efforts are at a high degree of detail or can be extracted for sub elements at a more regional level. This database can provide a baseline, against which trends/changes can be evaluated/monitored. The initiative integrates data and state of the art scientific capabilities from several agencies (USGS, NASA, EPA). It is expected that cooperation with other agency land managers will become part of the process as this research matures. Geographical scope covers an entire ecoregion with contextual themes, source imagery and derived data. A CDROM set is available with this data covering the entire Sandhills Ecosystem. Historical Trend Data is derived from the North American Land Characterization (NALC) data sets available from USGS. The NALC data provide satellite imagery for the1970s, 1980s, early 1990s, as well as elevation models. The NALC provide a consistent georeferenced data set and thus allows objective

evaluation of land cover (and therefore Landscape Ecology) trends over time. The land use classes for the derived data coordinate with those of the Multi-Resolution Land Characteristics (MLRC) data sets that use the standard Land Cover Classes of the National Land Characterization Data (NLCD).

Near real time ecosystem monitoring data comes from NASA's new Terra Satellite. Terra is the first satellite in a series that will collect a 15-year scientific data set. The data set is intended to help scientists follow environmental changes. Products derived from the Terra series are physical process derive, that is they are based on "First Principal" physical processes. Products are objectively derived, calculated by standard algorithms and repeatable. They represent cutting edge science that is inexpensive to obtain with new products available on a weekly, monthly or yearly frequency over a period of at least 15 years into the future. Therefore these products provide an excellent basis for long term ecological monitoring in the ESHEM initiative for over five decades.

For the Sandhills research we are using imagery products from the MODIS instrument. These are useful for landscape ecology. The generation of Landscape Ecology Indices can be a complex, lengthy undertaking, requiring substantial GIS-expertise. However, the Landscape Ecology Branch in cooperation with U.S. EPA Region 4 and TVA are developing a user-friendly interface to facilitate this process. ATtILA (Analytical Tools Interface for Landscape Assessments) calculates many commonly used landscape indicators automatically. For example, we can take the MODIS Land Cover file and use it for forest fragmentation research. ATtILA will classify forest fragmentation into five categories: patch, transitional, edge, perforated and interior. For the region surrounding Fort Benning GA, a statistical table allows us to conclude that there are larger and more extensive patches outside of Fort Benning. Those inside of Benning are part of the regional pattern. But most of the Benning forest is already in the transition class, meaning it has already been converted to a highly fragmented status.

This is only an example of how ESHM is intended to be applied. Other applications include Change detection, Encroachment and Sustainability, Ecoregional health monitoring capability and Base Realignment and Closure (BRAC).

Discussion and Summary

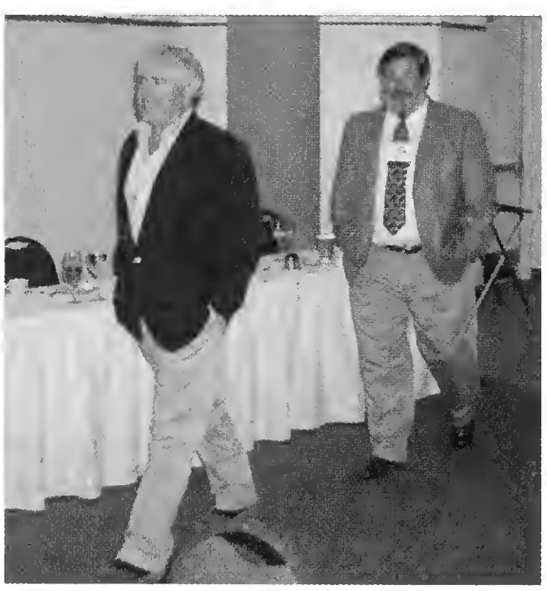
HAL BALBACH
US Army Engineer Research and Development Center
Champaign IL

One clear message emerges from the presentations in this symposium, This message, which is finally getting through to planners and biologists who are responsible for the management of public lands, is that the fence around the land has little meaning any more. Not that there aren't significant barriers to acting beyond the boundaries of the lands an agency owns, but that biology doesn't

care where the fence is. We are all actors within many circles of adjoining and surrounding systems.

Regional partnerships, the stated theme for the session, have been examined and presented in many different forms. Whether we are speaking of a single species, which is distributed across lands owned by many different parties, a large tract of land, which crosses many different systems, or multiple agencies that share oversight of a landscape, "Know your neighbor" is more important than ever. And not just know their name, but be closely involved with their management plans and goals, know about their successes as well as their challenges, and share in the difficult tasks which always seem to appear to the managers. If you develop a new tool to help you manage, share it immediately with the neighbor, if only to verify that it does what you think it does. Maybe they have some neat method to solve a problem you haven't faced yet. Learn from each others failures as well as successes. They want you to succeed, and you surely wish them luck as well, don't you? If not, why not? Generally speaking, you aren't really rivals…except maybe for bragging rights.

The concept of partnerships, especially when they cross agencies, and, more cautiously, when they include both public and private partners, is new to many of us. I believe, however, it is what will have to happen in the future. If the lands are physically joined, then their owners and managers must also develop ties so the whole becomes more than a collection of parts. Habitats don't care about ownership, per se, but the living things in those habitats definitely respond to what the owner has done with the land, for better or for worse. Take some risks. Share skills, information, and, if possible, budgets, with those who inevitably share your concerns. Moreover, if your agency has never attempted cooperative management, take the plunge. Start with a small item. Call it practice. Then, work up to larger issues with more potential for a significant benefit. Take some chances. Actively promote cooperation with your neighbors, even if your management chain has traditionally been wary of that sort of thing. I predict that, if we can follow the lead of the groups presented in this symposium, the experimental will become routine sooner than we might believe. Everyone will be a winner…and the land, the plants, and the wildlife will benefit most of all.



Executive Committee members at the 2002 annual banquet; Mike Dennis (left) and Zack Murrell.

The University Of Tennessee Arboretum Society Oak Ridge, Tennessee

More information about the society may be obtained from the Director, Richard M. Evans, by telephone (865) 483-3571, or e-mail revans6@utk.edu. The mailing address is 901 S. Illinois Avenue, Oak Ridge, TN 37831-5382.

The following two articles were reprinted with permission from the Vol. 22, No. 1, Spring 2002 issue of "The Leaflet."

What Do Bees Have to Do with Trees?

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Some people would quickly answer the title question by replying that bees use hollow cavities in trees as a home, a place where they live, and this would, of course, be correct. I remember a beekeeper who liked nothing better (his words) than locating a "bee tree" and finding a way to remove the bees. However, this is another story and has no relationship to the message I want to share with you here. Bees primarily "use" flowering plants including numerous woody shrubs and trees for food. This coadaptative partnership between plant and pollinator, where both benefit, is one of the most fascinating examples in nature of mutualism that we have. The plant reproduces and the pollinator receives food in the form of sugary nectar and protein-rich pollen. We often benefit by harvesting delicious honey as an additional product.

There are many tree species in the UT Arboretum and throughout North America that provide nectar or pollen or both and attract many species of bee visitors. When I refer to "bee" in this article, I intend "honeybees". In the spring, bees collect some pollen and nectar from silver and red maples and boxelder, as well as pollen from willows. These early food sources help the honeybee colonies build up. Redbud can also be a good nectar producer but the honey produced from this plant is dark, and although it is good for bees, the human taster normally utters an oath followed by "yuck" as it hits the tongue.

The black locust is an abundant, high quality nectar source in April in Tennessee and from it bees produce a light colored honey with a fresh, slightly tart taste.

Another prolific nectar producer is our state tree, the tulip poplar. A mature tree may produce millions of flowers one year and very few flowers the next. The magnolia-like blossom produces sweet nectar containing up to 35% sugar. Nectar secretion can vary due to soil and climatic conditions, especially moisture. Honey from tulip poplar is a beautiful deep red with a rich, robust flavor.

Every year beekeepers excitedly move colonies to the plateau area of Tennessee in anticipation of the bloom of the sourwood trees in June. Although these trees may only reach 40 feet in height, they produce multiple racemes loaded with small, bell-shaped flowers that remind me of a lily-of-the-valley. A beekeeping friend from North Carolina, Bob Cole, describes the tree during bloom, "like a fat old man wearing an overcoat". About every third or fourth year when the "right" conditions occur, sourwoods produce copious amounts of nectar that seem to drip from the flowers in a slight breeze. In other years, nectar production varies from moderate to very little.

The magnificent honey from sourwood has been called the "best in the world" and "nectar of the gods" and indeed, there is a definite mystique about it, elevating it to folk legend status. One man uses lunar cycles to predict the best flow years, but I will not go there. The color of sourwood varies from very light to a light amber with a slight pinkish tint. The taste is hard to define. It has a fresh, crisp taste and a distinctive mild, bitter after-taste that native Tennesseans refer to as a "wang". That is too technical. The best idea is for you to try it yourself. One taste is worth a thousand words.

An important characteristic of sourwood honey is that when pure, it does not granulate due to the high amount of fructose sugar it contains. If the label says "sourwood", check for granulation. Because of the higher price of this honey, the buyer should "beeware". This reminds me what an old beekeeper told me—"more sourwood honey is sold than is produced".

I'm looking forward to investigating nectar production in the sourwood nursery in the UT Arboretum. One approach is to move colonies of bees nearby and observe their foraging preference to see if they are more attracted to a particular selection. We can also measure nectar production and sugar concentration. If we can find a superior nectar producer, it could be the start of an effort to improve sourwood for bee food and for people food.

We can improve nectar production in trees. I applaud the efforts being made by George Ayers and others at Michigan State University to find high nectar-producing selections of black locust and basswood for breeding purposes to provide improved sources of nectar. If you ever observe a basswood tree in full bloom in clear weather, you could probably hear bees buzzing all over the canopy. George has conducted an extensive research program expanding twenty years to search for and propagate nectar-rich plants including numerous herbaceous and woody species. He has spent many seasons at the Morton Arboretum near Chicago and at the Arnold Arboretum at Harvard University. In fact, his own home acreage in Michigan is an ongoing experiment to select and grow plants that have overlapping bloom periods throughout the year and are nectar rich.

Bees and trees, they do seem to go well together.

Flowering Dogwoods in Tennessee: A Glimpse at the Past, Present, and Future

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Often significant research programs develop out of humble or serendipitous results that are generated by an isolated project. Such is the case for the very successful Dogwood Research Program at the University of Tennessee's Institute of Agriculture. The successes of the Dogwood Research Program are attributed, in no small part, to cooperation by the staff, volunteers, and Mr. Richard Evans (the Superintendent) of the University of Tennessee Arboretum, in Oak Ridge, Tennessee, as well as research cooperators from Mississippi, Alabama, Virginia, and North Carolina. More, these successes weren't achieved in one quick step—many people, multiple projects, and a myriad of factors have been responsible. For these reasons, the time has come to update you on the Dogwood Research Program: "Where We've Been", "What We've Done", and "Where We're Headed".

Where We've Been (and What Got Us There)

The University of Tennessee is a Land-Grant University with a three-part mission to: 1) Conduct Research, discovering new knowledge and developing ways to apply that knowledge to technology and products; 2) Teach, by educating undergraduates, Master's, and Doctoral students; and 3) Provide Service, by extending awareness of these tools and concepts to public and professional audiences.

Flowering dogwood (*Cornus florida*) has been called "the aristocrat of native flowering trees" by Dr. Michael Dirr of the University of Georgia, and identified as "the best ornamental of all the natives grown in the Northern United States", by Dr. Donald Wyman of the Arnold Arboretum. Named cultivars of *C. florida* generally produce more flowers at an earlier age than unnamed seedling trees and they may be more desirable for horticultural reasons, including expression of variegated leaves or characteristics of pest resistance.

In 1988, an outbreak of dogwood anthracnose spread quickly throughout eastern U.S. forests. Dogwood anthracnose is a debilitating plant disease caused by a pathogen, identified as *Discula destructiva*. Large, necrotic leaf spots appeared on native flowering dogwoods, particularly in shady habitats, and frequently foreshadowed tree decline and death. In 1993, insult was added to injury when powdery mildew, identified as *Microsphaera pulchra*, developed a simultaneous and extensive epidemic throughout the native range of flowering dogwoods. Powdery mildew on flowering dogwood was described more than 100 years ago, but the problem was never common. The writing on the wall was clear: these diseases had changed and were going to alter the ecology of eastern forests. They would also have a devastating impact on nursery production and landscape uses for this outstanding ornamental tree . . . and no

state produces more flowering dogwoods than Tennessee. In 1998 Tennessee nurseries produced 23% of all of the dogwoods sold in the U.S.: more dogwoods than the next two leading states, North Carolina and Oregon combined.

Dr. Mark Windham, a research pathologist at UT with the Entomology and Plant Pathology Department, and Dr. Robert Trigiano, a molecular pathologist with the Ornamental Horticulture and Landscape Design Department at UT (who is now with the Entomology and Plant Pathology Department) initiated dogwood research. The first research projects were undertaken with support funds from Mr. Hubert Nicholson, a Tennessee nurseryman, and grants from the U.S. Department of Interior, U.S. Forest Service, and U.S. Department of Agriculture. The Dogwood Research Program was off and running and the Team, who are profiled on our web page (*http://dogwood.ag.utk.edu*), grew quickly. Objectives were established to 1) identify disease-resistant flowering dogwood trees, and 2) create a breeding program for disease-resistant cultivars of flowering dogwoods using traditional and biotechnological approaches.

What We've Done

Field explorations were undertaken throughout eastern forests to locate anthracnose-resistant trees. From a pool of just a few contenders, one tree was found in Maryland at Catoctin Mountain Park that fit the bill. Cuttings were successfully rooted and happily so, since the original tree was killed when another less fortunate dogwood collapsed on top of it. After rigorous testing, a trademark for *Cornus florida* 'Appalachian Spring' was applied to this sturdy survivor. The first limited quantity of 'Appalachian Spring' trees was commercially available to wholesale markets this year—10 years from the date of discovery. Nursery production fields were scoured during 1994 and 1995 for seedlings that exhibited potential powdery mildew resistance characters. A greenhouse at UT was converted to a "killing floor" that housed vector trees with severe cases of powdery mildew. Seedlings were subjected to tremendous disease pressure and only the fittest trees were retained: of 153 possibilities, only 22 trees made the cut. Cuttings of these trees were screened in the field and the best-of-the-best were identified for flowering quality, growth habit, and tree form. Plant patents for *Cornus florida* 'Jean's Appalachian Snow', 'Karen's Appalachian Blush', and 'Kay's Appalachian Mist' are pending. The first trees are expected to be available in Tennessee's wholesale markets in 2004. A traditional breeding program has been established, using honeybees and sugar solution as a supplemental nectar supply (dogwood flowers produce very little nectar). Non-traditional breeding projects are also in progress.

Where We're Headed

Several future goals remain. One obvious objective will be to develop flowering dogwood cultivars that are resistant to both anthracnose and powdery mildew diseases. Achieving this combination of disease resistance is expected to be a challenge since several genes are likely to be involved. Trees with specific and desirable horticultural characteristics may also be candidates for genetic transformation. Transformations will enable a specific characteristic to be expressed by trees into which the functional gene is inserted. Another objective is to develop improved seedling and clonal rootstock quality. Rootstock improvements will, in turn, enhance disease resistance and establish greater

uniformity in tree appearance—all of which increases the demand for high quality, Tennessee-grown flowering dogwoods and contributes to a sustainable landscape. To date, the Dogwood Research Team has received more than $927,000, including significant contributions from Tennessee's nursery producers, for direct research support. These funds have generated considerable dividends for both knowledge and disease-resistant cultivars (*see the text box that accompanies this article*). However, the increased competition for research funds and the current decline in available support dollars is expected to continue. Reductions in the monetary fuel for research will impede the rate of success of the Dogwood Research Team, but our goals are worthwhile and the benefit to our natural environment will be significant. Stay tuned, because the Future for flowering dogwoods in Tennessee is Bright. *To learn more, visit us at the UT Dogwood Web Site* ***(http://dogwood.ag.utk.edu)***.

Successes of the Dogwood Team

- 21 articles published in professional scientific journals
- 10 articles published in trade journals
- 16 articles in UT publications
- 40 presentations to industry groups
- 4 new cultivars
- 3 plant patent applications
- 1 trademark
- Efficient DNA fingerprinting methods for woody plants
- Training and expertise extended to students, staff and faculty

Phantastic photographer for the 2002 annual banquet, Dr. Wayne Van Devender.

ALL TAXA BIODIVERSITY INVENTORY (ATBI) GATLINBURG, TENNESSEE

More information about the ATBI and Discovery Life in America (DLIA) may be obtained from the Administrative Officer, Jeanie Hilten, by e-mail jeanie@discoverlife.org. The website is www.discoverlife.org, and the mailing address is 1314 Cherokee Orchard Road, Gatlinburg, TN 37738.

The following four articles were reprinted with permission from the Vol. 3, No. 1, Winter Newsletter, 2002 issue of the "ATBI Quarterly."

MICROORGANISMS AS THE CORNERSTONE OF THE SMOKY MOUNTAIN ECOSYSTEM

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Cullowhee, North Carolina

The role of the infinitely small in nature is infinitely large. These words have been used to underscore the critical part played in every environment by microorganisms. Fungi, algae, protists, bacteria, and archaea are all important organisms in Great Smoky Mountains National Park—even if many require a microscope to see them. I study bacteria and archaea, single-celled organisms that are found in amazing habitats, in high numbers, and display incredible diversity.

Bacteria are given a bad name due to the few species that cause disease in humans, livestock, and crop species. However, greater than 99% of all bacterial species are harmless and many are beneficial to humans, plants, and animals. In fact, without bacteria most life would cease to exist. Microorganisms in the guts of animals help to digest food and supply their hosts with essential vitamins and nutrients. Many microbes associated with plants live in the root zone, supplying plants with nutrients such as nitrogen and phosphorous.

White clover root hair tip showing associated symbiotic bacteria (*Rhizobium trifolii*) which fix nitrogen. Early attachment of the bacteria is initiated by plant sugar exudates that attract the bacteria to the root hairs (image is 12 micrometers across).

Typical stream water has millions of free-living microorganisms per milliliter while soils may have billions of microbes per gram. In one gram of soil there may be more bacterial cells than humans on the planet and with thousands of species living together! Any habitat imaginable, short of molten rock, is home to many microorganisms. From the ocean depths to the atmosphere, from the boiling water of hot springs to Antarctic ice, and from the deep rock subsurface to the soil zone, life is present and active. What microorganisms are doing in their environments is still an open question and one that I will address in a few habitats in the Smokies.

There are probably millions of bacterial and archaeal species on Earth, most of which have not yet been discovered. Microscopically, many of these species are indistinguishable. It is only by their metabolic differences that most microorganisms can be separated into coherent groupings. For example, a broad classification defines two large groups of microbes; those that obtain energy from photosynthesis versus those that obtain energy from chemicals in their environment. The role of microorganisms in the cycling of elements such as carbon, nitrogen, sulfur, and iron is perhaps the most environmentally relevant way to describe microbial diversity. On an ecosystem level, the biomass of these single-celled organisms is substantial, leading to massive exchange of nutrients between the microbes and other life forms as well as the soil, water, and atmosphere in their ecosystems.

The research that I am planning to carry out in the Park is twofold and includes the following objectives: 1) to document the species of bacteria and archaea that may be found in diverse habitats in the park, including groundwater, surface water, and soil, and 2) to define the communities in these environments based on species diversity and metabolic diversity. Dozens of new species will be described in these studies using DNA fingerprinting and metabolic analyses. Furthermore, with long-term studies, the changes in communities based on environmental changes such as atmospheric pollutant input, Anakeesta Formation leachate, and seasonal effects will be characterized. Changes in the community structure based on the dynamics of dominant species and their

metabolic processes (e.g., nitrification, iron oxidation) will be assessed. It is expected that such long-term studies will be useful in environmental monitoring of the Park while at the same time reveal the great diversity of microbial species within it.

Image provided courtesy of Frank Dazzo from the Michigan State University Center for Microbial Ecology. The image was originally published in F.B. Dazzo and W.J. Brill. 1979. Bacterial polysaccharide which binds Rhizobium trifoli*i to clover root hairs. Journal of Bacteriology. 137: 1362-1373.*

Science Center Planning and Design

Keith Langdon
Great Smoky Mountains National Park
Tennessee-North Carolina

For 20 years, Great Smoky Mountains National Park has expressed its intention to build a new lab at Twin Creeks. With assistance from the Friends of the Great Smoky Mountains National Park, Senators Fred Thompson and Bill Frist, and many NPS personnel, this facility is about to become a reality. Planning for the ~15,000 square foot Science Center is over 75% complete as of January 2002, and if the required reviews are completed on time, the construction bids will be let in early fall.

The building will include the critically needed curatorial space for the natural resource specimens, a very large flexible work room for use by visiting scientists and NPS staff, a wet lab, a Geographic Information System room, and a sizable education room. An invertebrate "rearing room" and offices for the Park's Inventory and Monitoring staff and partners are also planned. The planning and design team have developed a functional and flexible building floor plan to accommodate changing needs over time. A major theme of the design is to foster interactions between NPS staff, visiting scientists, agency partners, such as Discover Life in America and the US Geological Survey, and especially youths and citizens.

It is important for everyone to remember that at the first ATBI in 1997, the Park asked the assembled group of 100 people what were the most important things we could do to increase quality science partnerships over the long term. You told us: 1) a good work facility, 2) lodging nearby, and 3) a host friendly/less bureaucratic environment. You have had a major influence on the design. We also appreciate the valuable input of the folks at the 2001 ATBI Conference who made specific suggestions.

As part of the package that went to the Congress for funding, the Friends agreed to rehab buildings or build a new building that would provide nearby lodging for scientists engaged in work in the Park. Specific planning on the lodging has not yet begun.

If you have suggestions or want to look over the plans for the Science Center, please contact Dianne Flaugh at Dianne_Flaugh@nps.gov. Meanwhile, we are preparing for several reviews by government facilities development panels to ensure compliance with energy conservation, ecological sustainability and cost efficiency. The NPS is planning to require a 12-month deadline for construction, once the contracts are awarded. With luck we may have photos of the groundbreaking in the fall issue!

Why Care About Biodiversity of Microbial Communities in Great Smoky Mountains National Park?

Steven W. Wilhelm
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Perhaps the most over-used and misunderstood word in the scientific vernacular is "biodiversity". Like many buzz words, it has different meanings to different people. In the eyes of microbial ecologists, biodiversity refers to the information stored in the genetic codes of organisms. The expression of this information manifests itself as the different characters (phenotypes) scientists employ for the delineation of different species. As such, more than 99% of the biodiversity in Great Smoky Mountains National Park (GRSM) is tied up in the unseen masses of microorganisms that inhabit the Parks lakes, streams and soils. In fact, it is safe to say that the microbial diversity in a cup of river water exceeds the diversity of all the Park's plants and animals combined.

It has been estimated that most of the living carbon on the planet is microbial in nature. In general, we now know that bacteria persist in aquatic environments at numbers of 10^8 – 10^{10} per L. Viruses are even more abundant in natural systems, and can range from 10^9 – 10^{11} per L. Although invisible to the naked eye, microorganisms (including bacteria, fungi, algae and viruses) dominate every known niche. While commonly considered as only agents of disease, they are in fact a natural part of any ecosystem.

In the last two decades, an understanding of the importance of the ecology of systems has moved from discussions amongst academics to discussions in many households. Society has gained an appreciation for the cycle of growth, death and rebirth that passes carbon and nutrients through systems. Microorganisms play a critical role in these processes at all levels: photosynthetic organisms convert CO_2 into biomass and stored energy, viruses and grazing organisms kill photosynthetic organisms and convert the material to organic waste, and bacteria consume these components and return CO_2 back to the atmospheric pool.

As part of the ATBI, the Aquatic Microbial Ecology Research Laboratory (http://web.bio.utk.edu/wilhelm/) at the University of Tennessee has begun a program to examine the GRSM microbial communities. Working from a site on Little River, we have been monitoring viral and bacterial abundances for the past

15 months. As a contrast, we also sample a site in Fort Loudon Lake. Our studies demonstrate that bacteria and viruses in Little River show a springtime increase in abundance similar to that seen in lakes. The long-term goals of this research are to characterize the diversity and activity of bacteria and viruses in this system.

Characterizing bacteria in the GSMNP ecosystem

Understanding which bacteria are present and active members of the GRSM ecosystem is a daunting task. However, it is a necessary task as we can subsequently make basic predictions about their specific biochemistry and thus their role in the ecosystem. Modern day microbial ecologists rely on state-of-the-art molecular tools to dissect and characterize these systems. DNA can be extracted from soil or water samples and purified in the lab. Using a technique known as the Polymerase Chain Reaction (PCR), many copies of microbial genes can be made to provide enough genetic material to study. While a variety of genes can be used for this process, most research involves the 16s rDNA gene. This gene encodes a nucleic acid fragment that forms a subunit of ribosomes, which carry out protein synthesis. As such, the DNA sequence of this gene changes very rarely and provides a platform for the study of the relatedness of distantly related organisms. As a large number of researchers have focused their studies on this gene, a large database allows us to take DNA sequences from unknown fragments and determine which bacteria they were amplified from. Analysis of a series (often hundreds) of these fragments slowly helps us assemble a picture of the microbial community structure.

The ecology of viruses in natural systems

Today, we no longer think of viruses as pathogens that just cause disease in animals and plants, but also as integral parts of natural ecosystems. In systems such as the rivers in the Park, viruses regenerate nutrients for phytoplankton and bacteria as they lyse the organisms they infect. Our preliminary work suggests they play an important role in recycling organic carbon to bacteria. Other insight suggests they also play an important role in controlling the diversity of bacteria in a system. Unfortunately, the current research only scratches the surface of the pivotal role viruses play in these systems.

Future directions in microbial ecology

Currently, work in both the Aquatic Microbial Ecology Research Laboratory and in the UT Center for Environmental Biotechnology (http://www.ceb.utk.edu/) is moving to provide insight on microbial diversity and activity in GRSM. New technologies, stable funding and increased public interest are driving researchers to resolve issues concerning this unseen biodiversity. Not only does this provide scientists with a better understanding of the system, but it also provides UT educators with a platform to train students in microbial ecology, environmental engineering and biotechnology that will augment the activities in the Park and ultimately the quality of life in East Tennessee.

Acknowledgments. Research described in this article is the work of University of Tennessee Researchers (Amanda Dean, Dr. Gerda Harms, Melanie Eldridge) and has been sponsored by funds from the National Science Foundation (DEB-0003069) and Discover Life in America.

Aquatic Oligochaeta in the Great Smoky Mountains National Park, North Carolina and Tennessee

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Florida Department of Environmental Protection, Tampa

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The Oligochaeta, one of several groups of true-segmented worms in the Phylum Annelida, are commonly found in terrestrial, as well as marine, brackish, estuarine, and freshwater ecosystems on every continent. Other groups of segmented worms in this phylum include the Polychaeta, or bristle worms—primarily marine, with several freshwater and estuarine species; the Hirudinea, or leeches—primarily freshwater, with several marine and terrestrial species; the Branchiobdellida, or crayfish worms—almost exclusively associated with freshwater crayfishes; the Aeolosomatida, or suction-feeding worms (now considered to be polychaetes)—freshwater; and the Acanthobdellida, or bristle leeches—with only one or two species associated with marine fishes in Arctic waters.

As is true for all groups of organisms, some oligochaetes are restricted to unique as well as disjunct habitats such as caves, springs, other groundwater habitats, and even thermal vents in the oceans. Many are endemic to a single or limited number of sites. While most oligochaetes are free-living, several species have commensal relationships with other animals, and many species are commonly associated with aquatic and terrestrial plants.

Worldwide, oligochaetes range in length from less than two-hundredths of an inch to almost 10 feet! However, you will not find a 10-foot worm unless you go to Gippsland in Australia. The largest terrestrial worm you may encounter in the Great Smoky Mountains National Park may reach a length of 10 inches; the longest aquatic species may reach a length of 1.5 inches. Like all annelids, oligochaetes are bilaterally symmetrical, with an elongate, cylindrical body shape divided both externally and internally by a regular, linear series of segments. The number of segments is relatively fixed in some annelid groups, but indeterminate in others. The highly developed digestive, circulatory, nervous, and excretory systems within the body cavity (coelom) reflect external segmentation, and generally are repeated serially; this is called metameric segmentation, distinguishing annelids from all other worm-like groups.

Externally, annelid form is diverse, even within each group; many polychaetes may have distinct body regions, with limb-like parapodia, chaetae (hairs), tentacles, and antennae, while others may appear similar to an earthworm, with few if any external appendages. Most oligochaete species have chaetae arranged in bundles on nearly every segment, and several aquatic oligochaete species have gills, eyes, and/or a proboscis. Oligochaetes are

hermaphroditic (both are sexes present in each individual); reproduction is commonly sexual, but many species reproduce asexually by budding or fragmentation.

Oligochaete worms are important components of their respective habitats—streams, lakes, ponds, springs, the ocean, or soil. The feeding habits of many species are important in the decomposition of organic matter and recycling of nutrients in terrestrial and aquatic environments. Aquatic oligochaetes, like several other groups of plants and animals, have long been recognized as indicators of water quality. In fact, Aristotle [384-322 B.C.] has often been cited as the first person to associate a writhing carpet of red worms with raw sewage. Aristotle most likely observed large colonies comprised of several oligochaete species in the family Tubificidae, or sludgeworms.

Although a few aquatic oligochaetes can be identified under a dissecting microscope, most species must be mounted on microscope slides and observed at high magnification under a compound microscope before accurate identifications can be determined.

While aquatic oligochaetes commonly are an important and often dominant component of the benthic community, specimens rarely are identified beyond class or family level because of perceived difficulty in taxonomic resolution. To bring the study of Oligochaeta into perspective, we currently recognize 38 families, 807 genera, 60 subgenera, and over 8,250 nominal species of terrestrial and aquatic species of oligochaetes, worldwide. Over 200 species of freshwater oligochaetes representing 13 families and 74 genera are known to occur in North America; of these, at least 10 families, 58 genera, and 120 nominal species are known or thought likely to occur in the southeastern U.S., including earthworm species occasionally collected from aquatic and muddy habitats.

Over the last 40 years, many publications have focused on the distribution, ecology, classification, taxonomy, and systematics of aquatic oligochaetes at the North American, regional, and state/provincial levels. No published papers have summarized the distribution of aquatic oligochaetes in the Great Smoky Mountains National Park, although several papers have provided collection records for a few taxa.

Small grants awarded by Discover Life In America, Inc. (DLIA) have supported our collection of aquatic annelids and other macroinvertebrates from 80 sites within the Park as part of the All Taxa Biodiversity Inventory (ATBI) project; these include 62 stream sites, 15 springs or seeps, a pond, Gum Swamp, and rimstone pools in Gregory Cave. Field collections were conducted in September 1999, September 2000, April and September/October 2001, and April and August 2002. Funding from DLIA is also supporting surveys in the Park for other groups of annelids—Dr. Samuel W. James (Maharishi School of Management) is studying terrestrial Oligochaeta, and Drs. William M. Moser (U.S. National Museum-Smithsonian Institution) and Donald J. Klemm (U.S. Environmental Protection Agency), are studying leeches. An article focusing on the terrestrial oligochaetes of the Park, written by Dr. James, was published in

the autumn 2000 ATBI Quarterly; an article focusing on the leeches of the Park, written by Drs. Moser and Klemm, was published in the autumn 2001 ATBI Quarterly.

In September 1999, a preliminary checklist of aquatic and terrestrial annelids known to occur in the states adjacent to the Park was established on the World Wide Web: http://www.inhs.uiuc.edu:80/~mjwetzel/AqAnnel.GSMNP.html.

This site also provides a summary of field surveys for aquatic Oligochaeta conducted in 1999, 2000, 2001, and 2002—locality information for collections, field and laboratory methodologies, status of samples and specimens that have been collected from the Park, and pertinent literature.

To date, 13 species representing 8 genera and three families of aquatic oligochaetes have been documented from the Park, all representing new Park records; the collection of Rhyacodrilus subterraneus (Tubificidae) represents a new state record for North Carolina. Representatives of two other families of aquatic oligochaetes, and three other annelid groups (the Aeolosomatida, Branchiobdellida, and Hirudinea), also have been collected during this study. The density and diversity of oligochaetes in samples collected to date is surprising low, considering the diversity of physical habitat present at each site. Additionally, many specimens collected to date have been immature, preventing species-level determinations.

Future surveys for aquatic oligochaetes in the Park will be conducted in streams and springs draining to the north, one to two other caves that contain standing or flowing water, small seeps and springs that occur at high altitudes, and several minor drainages flowing south, particularly those that flow into the impoundments of the Little Tennessee River system.

Incidental oligochaete specimens collected by other biologists will be identified as time permits. Voucher specimens of each oligochaete species will be permanently deposited in the central ATBI repository at the Twin Creeks research facility in the Park; other specimens will be deposited in the INHS Annelida Collection in Champaign. Non-annelid macroinvertebrates are being sent to other invertebrate taxonomists working on the ATBI project, who then will identify the specimens and incorporate the resulting information into their reports and publications. Data relating to the collection and identification of aquatic oligochaetes from the Park will be included in the INHS Annelida Collection Database, and conveyed to Dr. Norman Johnson and Luciana Musetti for assimilation into the ATBI Database.

The success of this investigation for aquatic oligochaetes in the Park is the result of the cooperative efforts of many individuals. In particular, we recognize the continued support and suggestions from Keith Langdon and Becky Nichols (NPS-GRSM), Jeanie Hilten and Chuck Parker (ATBI), John Morse (Clemson University/ATBI Science Committee), and Frank Harris (Chairman, Discover Life In America Board of Directors).

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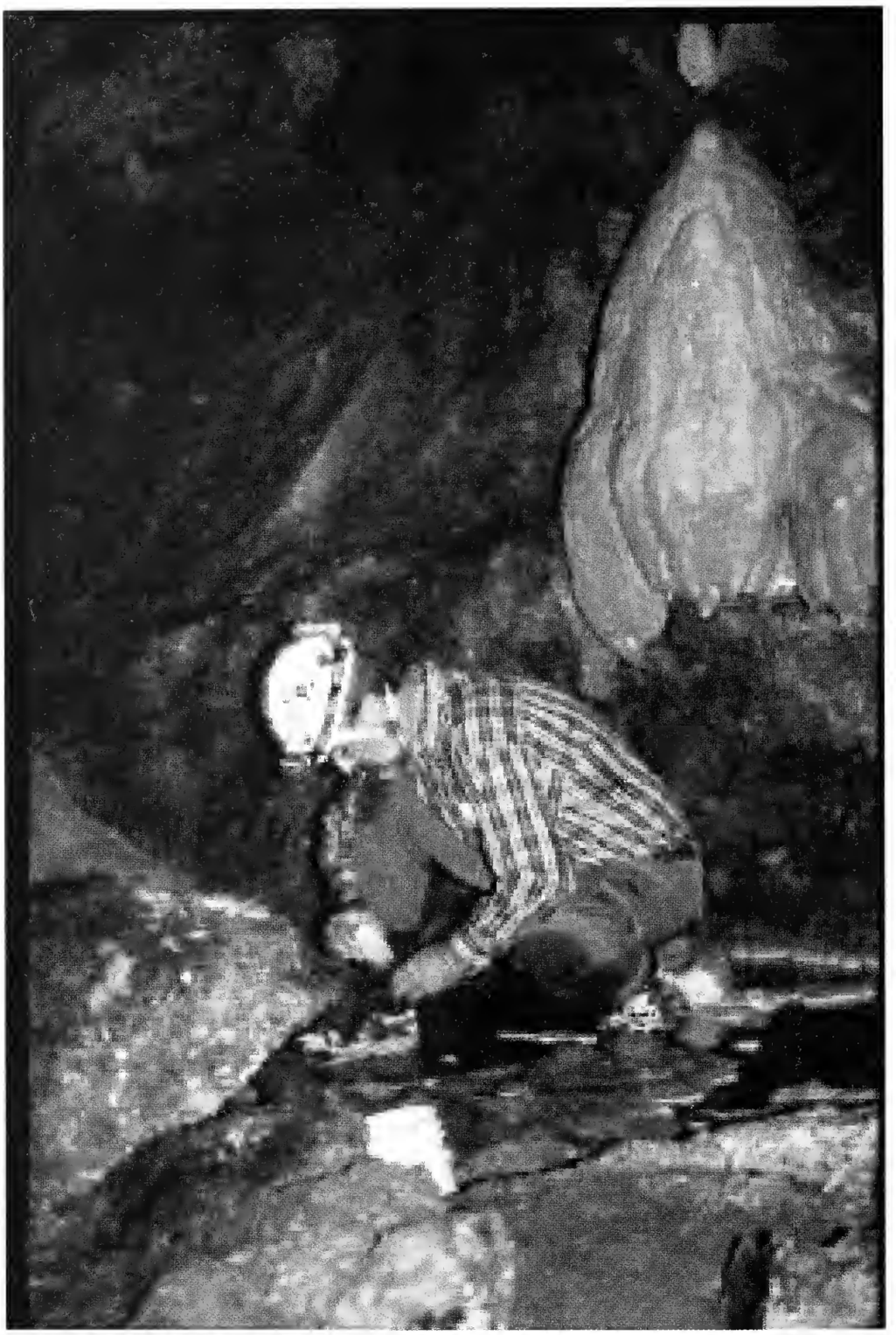

Mark J. Wetzel (INHS), collecting aquatic oligochaetes from rimstone pools in Gregory Cave, Great Smoky Mountains National Park, 24 April 2002. Photo by Rebecca P. Shiftlett (DLIA-ATBI Photographer).

Obituaries

Howard Thomas Odum, 1924-2002

Howard Thomas Odum died on September 11, 2002, after a short bout with cancer. He was 78 years old. Born of the South (in Chapel Hill, North Carolina, in 1924), he held faculty positions in five universities during his strikingly productive career: University of Florida (twice, 1951-54, and 1970-2002); Duke University (1954-56); University of Texas 1956-63; University of Puerto Rico, 1963-66; and University of North Carolina at Chapel Hill (his original alma mater, 1966-70)—none north of the 36th parallel. He did his Ph.D. under G. Evelyn Hutchinson at Yale on the global biogeochemistry of strontium, publishing his findings in Science in 1951.

He was the author of more than 300 publications, the first (on bird migrations) in 1945, others still in press. These include some 15 books ranging from those that emphasized ecosystems and regions (e.g., the massive, award-winning tome on a Puerto Rican rainforest), to treatise-like texts (e.g., on systems ecology), to volumes that reached beyond the ecological to address broader issues of environment, society, and economics. During a 1989 birthday symposium in Chapel Hill, a double-wide stack of his publications served comfortably as a lectern for even the tallest celebrants. Although no biography has been written, the breadth of H. T. Odum's contributions through the mid-1990s is covered in the combination of Taylor (1988), Hagen (1992), Mitsch (1994), Hall (1995), and Golley (1996).

A sampling of H. T. Odum's many honors includes three he shared with his brother, Eugene P. Odum: the Mercer Award, from the Ecological Society of America (in 1955, for their work on coral reef metabolism and biogeochemistry), the Prix de Vie (from the French government's Institut de la Vie, 1976), and the Crafoord Prize (awarded by the Royal Swedish Academy in 1987). Although some of his awards received wider international publicity, he was especially proud of the presidential recognition he received during World War II for his work on hurricane prognostication: Lt. Odum was, among other things, an excellent meteorologist.

Those familiar with H. T. Odum's scholarship primarily through his contributions of the past 20 years may not know that he was also an outstanding student of natural history. He knew the microbial soups of springs and microcosms, the molluscs and crustaceans of inshore marine communities, the plankton and benthic fauna of cypress swamps, and the complex biota of a rain forest. But organisms were always more than binomials, and if students were told what it was, they were inevitably told (or encouraged to find out for themselves) what it did. When I joined the faculty at the University of Florida, he and I exchanged addresses, to which he instantly remarked "Good! We share the same red-headed woodpecker home range!" (We did.)

H. T. Odum's recipe for an ecological education was straightforward: sound basics (math, chemistry, physics), knowledge at four scales (individuals, populations, communities, biomes), familiarity with three abiotic worlds (atmosphere, hydrosphere, geosphere), and exposure to three environments (marine, freshwater, terrestrial). It was hard to argue curriculum with a man who published across that full range of disciplines.

A partial accounting of H. T. Odum's contributions to our knowledge of the ecology and biology in the southeastern U.S. would include the solution to the riddle of the Carolina Bays, quantification of the trophic structure and energy flow in springs, use of cypress ponds as treatment plants for secondarily treated sewage, and integration of the large-scale hydrology and human ecology of South Florida. His view was always top-down, always synthetic, and always addressed a context larger than the immediate target of his research. He rarely engaged in theory free of an empirical context, whether it was maximum power, transfer efficiencies, frequency distributions, diversity measures, or ecological economics.

H. T. Odum had an uncanny ability to turn one's world around 180 degrees, more often than not converting doomsday into optimism. If the topic was acid rain, he wanted to know where all the bases were; if it was non-indigenous species, he heralded the new services being provided; and if it was devegetation by sacred cows, he pointed to their roles as draft animals.

Highly principled, H. T. Odum always stuck to his convictions, even when the easier path often would have been to mount the bandwagon of peers. On the one hand, he was a fierce though friendly competitor: they are still looking for opponents' croquet balls he sent sailing off court at the Duke Marine Lab, and pity the poor graduate student, especially any large male, who ended up across from him on the volleyball court. On the other, he went out of his way to foster the underdog, especially those whose opportunities had been limited by factors beyond their control. To say that he was a gentleman vastly understates his genteelness; to tag him a scholar is too small a label for one of science's greatest minds. One of H. T. Odum's dicta was that, in order to understand a system, you had to understand the next larger system of which it was a part and the smaller systems of which it was composed. Biologists of the southeast can be proud that his system was our system, and his perceptions of its global fit have advanced science for all.

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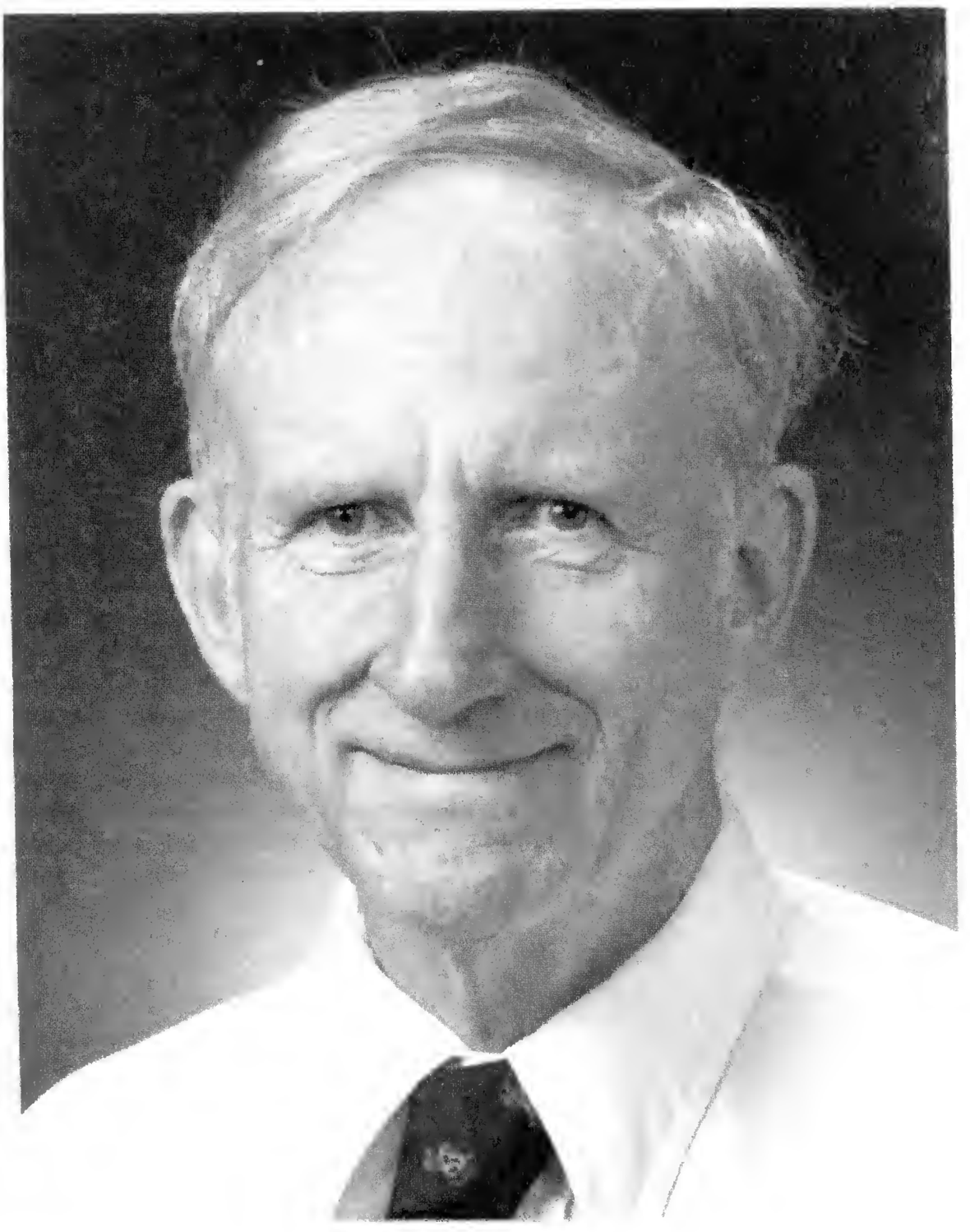
John J. Ewel, Institute of Pacific Islands Forestry, Honolulu, Hawaii

I thank my colleagues—Scott Nixon, Ariel Lugo, Sandra Brown, Bill Mitsch, Mark Brown, and Kathy Ewel—for their input.



Howard Thomas Odum

Eugene Pleasants Odum, 1913-2002

"The ecosystem is greater than the sum of its parts" encapsulates the holistic view of nature and the science of ecology held by environmental visionary Eugene P. Odum. The quote is inscribed on the bronze bust that adorns the entrance to the Institute of Ecology building at the University of Georgia. Even from his early days as a naturalist, Eugene Odum perceived an interface between the natural and social sciences that ultimately led to vintage Odum ecology, which many refer to as "ecosystem science." Gene Odum died at his home on August 10, 2002, at the age of 88, upon completing the 5th edition of his famous textbook, *Fundamentals of Ecology*.

Eugene Pleasants Odum was born September 17, 1913, in Chapel Hill, North Carolina, where his father, Howard W. Odum, was a professor of sociology well known for his pioneering work on southern regionalism. As a youngster, Gene spent hours in the woods, tracing the nearby streams observing the animal life, and by the time he was a teenager he was obsessed with birds. He began writing about his observations early; in high school, with a typewriter and a mimeograph machine, he started a bird magazine called "The Briarbridge Bird News." This evolved in 1931 into a column, "Bird Life in Chapel Hill," which he and a friend wrote for the local newspaper, taking turns writing the weekly essays.

After completing A.B. and A.M. degrees from the University of North Carolina, Gene Odum received his Ph.D. in 1939 from the University of Illinois where he studied with the well-known ecologist, Charles Kendeigh. In the fall of 1940, he took a full-time job as an instructor of zoology at the University of Georgia, where he remained throughout the rest of his illustrious career. He was the only ecologist in a department of five faculty members, none of whom were impressed with his new ideas of studying entire ecosystems. The more he thought about ecosystems, the more he was convinced that there should be a way to study how one part affects another. This was in a day long before computers, global information systems, and mass spectrometers, and only the most basic tools in the field, lab, or office were available to understand how biological and physical systems interacted. Yet, with the single-minded determination that became the hallmark of his approach, Gene Odum set about developing a revolutionary view of how ecosystems worked. Much has been written about Odum's phenomenal contributions to science, two prominent accounts being by Barrett and Barrett (2001) and Craige (2001).

In the late 1940s, the U. S. Atomic Energy Commission made a decision that would have a profound effect on Odum's career and the future of ecology, in establishing the Savannah River Plant in South Carolina. Gene Odum received in 1951 an AEC grant for $10,000 to conduct studies to determine how the site might be affecting the local biota. He immediately recognized the unique opportunities afforded by the thousands of acres of abandoned cropland and convinced the AEC to support studies of ecological succession as well as biological inventories. Few large-scale studies of natural succession had been conducted in the Southeast, and none had integrated development of both plant

and animal communities in the process of succession and energy flow through biological food webs.

In his typical fashion of investing in the development of young scientists, Odum used the funds to support three graduate students and provide a truck for field travel, rather than for faculty salaries. This humble beginning led to the establishment of the University of Georgia's Savannah River Ecology Laboratory, now internationally recognized for its research and education programs, and the 300-square-mile Savannah River Site has become one of the largest, self-contained environmental laboratories on earth.

In 1953, Gene Odum led in the establishment of the UGA Marine Institute on Sapelo Island, and pioneered research on the little known Georgia salt marsh estuaries. Again, the study of ecosystem processes was a major focus, and Odum brought together a group of young investigators with diverse backgrounds to develop an ecosystem-level view of the marsh. His varied pursuits came together when the University's Institute of Ecology was founded in 1960, with Gene Odum as its first director. The Institute immediately made a name for itself, training scientists committed to Odum's holistic method of looking at the world around us and today is recognized as one of the leading institutions in the world for training ecologists at the undergraduate, graduate, and post-doctoral levels.

Gene Odum helped educate an entire generation of ecologists globally when in 1953, in his early 30s, he published *Fundamentals of Ecology*. Prior to that time, of the many books on the ecology of parts of the natural world, none had examined the entire ecosystem, starting from the top down. For an astonishing 10 years, this was the only textbook available worldwide on ecosystem ecology. Odum argued that ecology was not a subdivision of biology or anything else. Instead, he promoted an integrated discipline that would bring all sciences together instead of breaking them apart. *Fundamentals of Ecology* has been translated into 12 languages and was recently ranked first by the American Institute of Biological Sciences membership as the book having had the greatest impact on career training during the past century. The fifth edition is scheduled for publication in 2003, co-authored with Gary W. Barrett.

Gene Odum earned numerous honors during his long professional life, including being elected to the National Academy of Sciences in 1970 and being named an honorary member of the British Ecological Society in 1974. With his brother, Howard T. Odum, he received the international "Institut de la Vie" prize from the French government, and he was awarded the prestigious Tyler Ecology Award – the world prize for environmental achievement, which was presented by then-President Jimmy Carter in ceremonies at the White House. He contributed the $150,000 from the award to the University of Georgia as an endowment for the Institute of Ecology. In 1987, Eugene and Howard T. Odum won the Crafoord Prize given by the Royal Swedish Academy, the equivalent of the Nobel Prize, which is not awarded in ecology. Eugene Odum's share of the money, $125,000, went to set up a private foundation for the promotion of research and education in ecology.

Gene Odum's wife, Martha, was a talented landscape painter who accompanied him on his years of travels, recording the "essence of place" in her many watercolors. Their son, William E. Odum, also an ecosystem ecologist, was

chair of the Department of Environmental Sciences at the University of Virginia until shortly before his untimely death in 1991.

Even almost 20 years after his retirement, Gene Odum remained active as a scientist, teacher, and colleague. He remained a friend of many, young and old, and his impact on ecology will extend far into the future.

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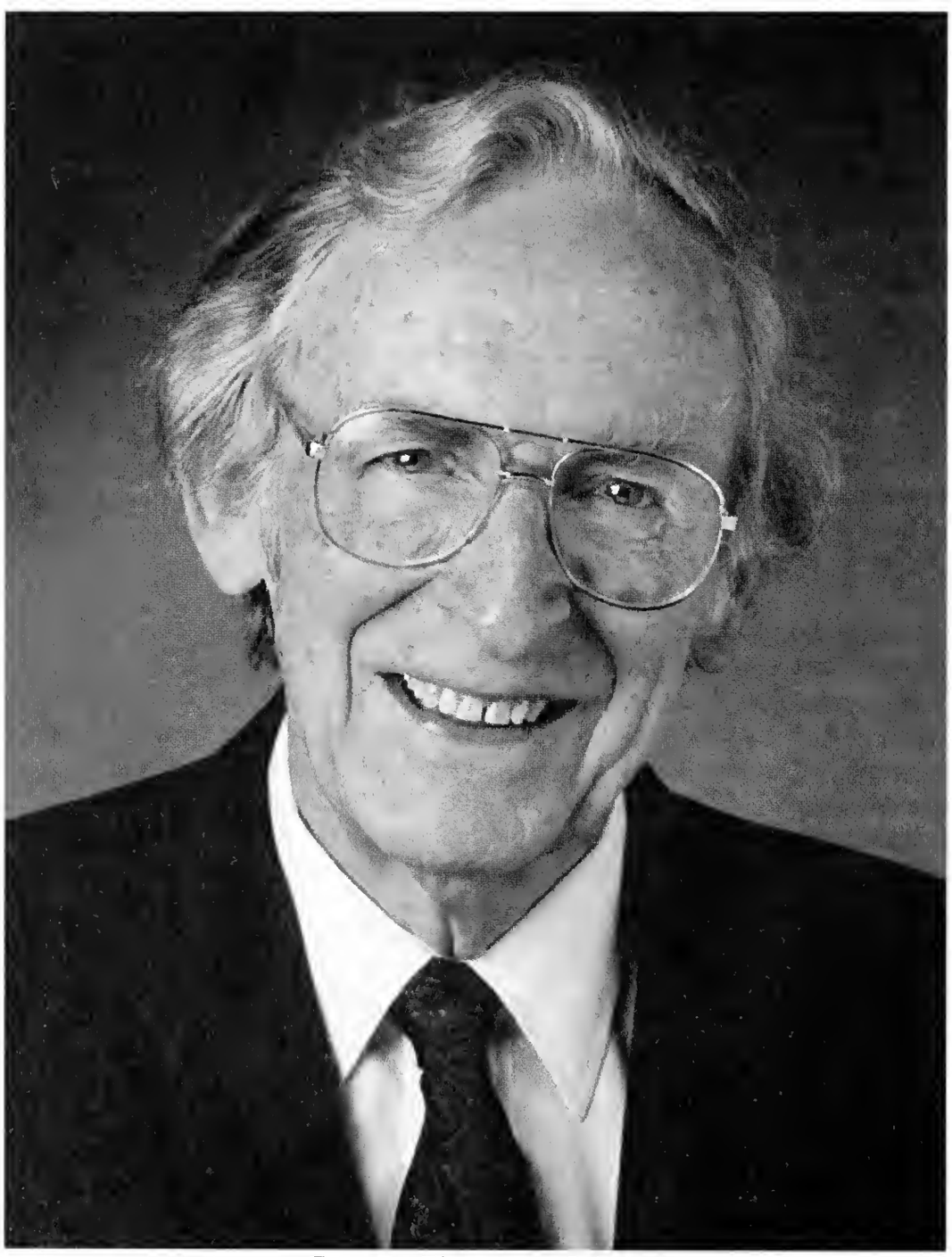
Craige, B. J. 2001. Eugene Odum: Ecosystem Ecologist & Environmentalist. The University of Georgia Press. Athens, GA.

Rebecca R. Sharitz and J. Whitfield Gibbons
Savannah River Ecology Laboratory



Eugene Pleasants Odum

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Volume 49, Number 3, September, 2002
Volume 49, Number 4, December, 2002

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(Required by 39 USC 3685)

	2. Publication Number	3. Filing Date
Southeastern Biology	1 5 3 3 - 8 4 3 6	
4. Issue Frequency Quarterly	5. Number of Issues Published Annually 4	6. Annual Subscription Price $25.00

7. Complete Mailing Address of Known Office of Publication (Not printer) (Street, city, county, state, and Zip+4)
Southeastern Biology, 810 East 10th P.O. 1897, Lawrence, KS 66044-0368

Contact Person
Beverly Prescott

Telephone
(785)843-1234 Ext. 131

8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer)
Southeastern Biology, 810 East 10th P.O. 1897, Lawrence, KS 66044-0368

9. Full names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do not leave blank)

Publisher (Name and complete mailing address)
Southeastern Biology, 810 East 10th P.O. 1897, Lawrence, KS 66044-0368

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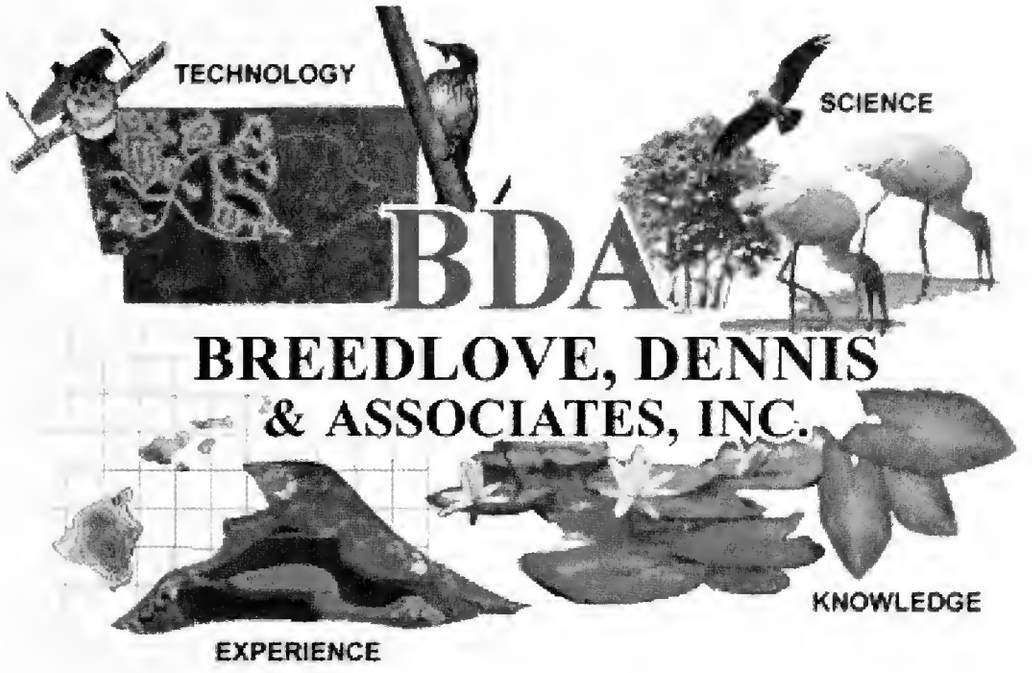

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SOUTHEASTERN BIOLOGY
VOLUME 49, NUMBER 4, December, 2002
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